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The city politics of an urban age: urban resilience conceptualisations and policies

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ABSTRACT Around the globe, cities seek to improve their resilience to face the stresses and shocks that are expected from global climate change and other threats. In implementing urban resilience policies, they are guided by different urban resilience conceptualisations. What is meant by the concept differs between scholars, governments, as well as international organisations that seek to study, advise on and implement urban resilience policies and governance interventions. This article presents a review of the urban resilience literature since the 1970s. It seeks to map and interrogate dominant urban resilience conceptualisations, and decipher whether and how different understandings of the concept can result in essentially different policies and governance interventions and outcomes. In contrasting the 'what' of urban resilience (various conceptualisations) with the 'why' of urban resilience policy (bouncing back, falling forwards, persistence) it investigates approaches to overcome some of the key critiques to urban resilience policy and research.

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Introduction

There is little debate that cities are at the centre of climate change mitigation and adaptation action (Seitzinger et al., 2012). Ever-growing cities, needed to house an ever-growing population, require an ever-growing amount of resources for their development and maintenance, and the often high-consumerist lifestyles of their residents (Dodman, 2009). At the same time, it will be in cities where climate change impacts—including sea level rise, longer, more frequent and intense heat waves and droughts, as well as disrupted rainfall patterns—will be most detrimental because of high population densities, but also because cities are the cornerstone of global economic and cultural activity (Taylor, 2013). In addition to climate change, urban policy-makers and implementers face other considerable challenges they need to adapt their cities to—including rapid technological change and increasing human-made threats such as terrorism and cyber-attacks.

Urban policy-makers and implementers need to be able to keep pace with the unforeseeable and a future that will inevitably be significantly different from even recent past experience, while also aiming to maintain and increase liveability and social well-being in cities. This realisation has led to a surge of resilience policies and governance interventions for urban systems, with Selchow, (2017) asserting that U.S. president Barak Obama used the word in his papers more often than any of his predecessors. The academic literature has closely followed this development, and has been particularly prolific in providing different interpretations of 'urban resilience'. Researchers, however, have not been speaking with a single voice. Recent reviews (Meerow et al., 2016; Manyena, 2006; Boyd et al., 2015), have found wide-ranging differences between definitions, focus, areas of application, and conceptualisations of urban resilience and the policies and governance interventions that seek to achieve it.

As is the case with any social and political construct, urban resilience has become an 'essentially contested concept' (Gallie, 1955; de Bruijne, et al., 2010). This article seeks to map and interrogate different urban resilience conceptualisations, and to understand some of the main critiques for urban policy-making within a political environment. This will help gain insight how different understandings of the concept may result in essentially different urban policies and governance interventions and outcomes.

Such insight is of relevance for urban policy and research. If policies and governance interventions across organisations—be they public, private or hybrids—are guided by different understandings of urban resilience this will lead them to focus on different types of threats and responses. Multiple understandings may be fruitful. It may result in a situation where various detailed aspects of urban resilience are addressed with tailored policy tools and governance instruments. Yet, it may be problematic also. Multiple understandings may result in organisations cherry picking specific aspects and leaving other aspects unaddressed, polemic turf-wars that will not result in action and, most challenging, a lack of cohesion in attempts to achieve meaningful urban resilience in and across cities; roughly what scholars have observed for environmental sustainability and urban climate change mitigation before (Washington, 2015; Knieling, 2016). Political cycles and drivers may also heavily influence the way issues are framed and consequently what conceptualisations are chosen for policy development.

Thus, the implications of these different ways of framing urban resilience need to be studied in more detail (Vogel and Henstra, 2015). This paper first seeks to understand the 'what' of urban resilience. That is, what is meant by the term in different settings. This includes the specific areas of focus, boundaries, and application of the term in policy and academia. Second, it seeks to understand the 'why' of urban resilience. That is, the motivations for urban resilience policy and governance interventions brought to the fore by policy-makers and academics. The paper concludes by stressing the relevance of addressing the 'what' *and* the 'why' when developing and implementing urban resilience policies. But before addressing these topics, the article begins with a brief explanation of the methodology underlying the analysis presented in what follows.

Methodology

The following sections present the findings from a review essay of published resilience literature within an urban policy and governance context, through a methodology similar to that outlined by Carey and Crammond, (2015). To get to a workable dataset of published material we scoped databases including Google Scholar, Scopus and our University's Library catalogue. Inclusion criteria were academic and policy papers and book chapters discussing urban resilience, resilience thinking, sustainable resilience, proactive resilience, and resilience and climate change policy. We excluded documents not published in English, and limited our search to the period 1970–2016. This resulted in 82 documents that form the base of the review that follows.[1] Documents were systematically read, analysed and coded according to the range of disturbances they focus on and whether they focus on short-term or long-term futures.

Within the context of this review article, policies and governance interventions are understood as the positions taken and articulated by government and other organisations that recognise a problem and state, in general terms, the actions to be taken to address the problem (Dovers, 2005). The term urban is understood as a system formed by a conglomeration of ecological, social and technical components. These form socio-technical, socio-ecological and eco-technological networks, where each component and their networks are dynamically changing and interacting with each other in often unpredictable ways. This concept builds on the characterisation of urban systems provided by Meerow, et al., (2016) and Ernstson, et al., (2010).

The 'what' of urban resilience: mapping, exploring and interrogating urban resilience concepts

The word 'resilience' has existed in the English language for centuries, originally meaning "the ability to recover from adversity", and has evolved to describe a number of different definitions applied to a variety of fields and used in public policies worldwide (Alexander, 2013). Over the last two decades, the use of the term resilience has gained particular traction perhaps driven by the growth of liberal democracies and their framing core values (Davoudi, 2016). This can be observed by the world's interest in "resilience" (measured in web searches of the term in Google) doubling just over the last 5 years and the number of books published (according to those available in Google) more than tripling since 1980.

Resilience is particularly a 'hot topic' in urban studies, geography and climate change scholarship (Meerow, et al., 2016; Manyena, 2006; Boyd, et al., 2015; Ernstson, et al., 2010; Haase, et al., 2014). The term resilience is also repeatedly mentioned with and as being related to sustainability: "A growing number of case studies have revealed the tight connection between resilience, diversity and sustainability of social-ecological systems" (Folke, et al., 2002, p 437). Indeed, within urban politics and governance practice there is some evidence that attention is shifting from urban environmental sustainability to urban resilience; where the term resilience is then often used to encompass environmental sustainability (van der Heijden, 2014; Schewenius et al., 2014).

When overviewing this literature, a few observations are particularly evident (explored in more depth below). The following sections summarise the core characteristics, policy implications and criticisms of some of the resilience concepts we uncovered in our review and the discussions in each section. First, there is no single definition for the term urban resilience and the available definitions range from capturing very narrow aspects and having a short-term focus (mostly related to responding to an experienced disaster) to ones that encompass a variety of aspects and potential threats and have a long-term focus (mostly related to preparing for big climatic changes) (Meerow, et al., 2016). Second, since the 1970s writings on urban resilience, as well as policies and governance interventions have moved from outcome oriented towards process oriented interpretations (Manyena, 2006). Third, there appears some consensus that urban resilience revolves around adaptability, flexibility, responding to external shocks, and being able to continue operation during an emergency or be able to bounce back to the pre-emergency state of affairs in a relatively short time period (Fiksel, 2003; Jabareen, 2013; Redman, 2014). Fourth, there is a rapidly growing body of literature critical of understandings and conceptualisations of urban resilience, as well as climate resilience policies and governance (Lister, 2016; Davoudi, 2014; Moffatt, 2014).

In what follows, we first unpack and analyse various resilience conceptualisations uncovered in the literature review (the 'what' of urban resilience), and focus on critiques to these conceptualisations and counter-critiques to those (the 'why' of urban resilience).

Disaster resilience. Disaster risk reduction forms a large portion of the literature available on urban resilience (Leichenko, 2011). While there is no single definition of disaster resilience this term is often mentioned in the literature in relation to the desired outcomes of an event with the potential to produce a disaster. "Disaster resilience is seen as the 'shield', 'shock absorber' or buffer that moderates the outcome to ensure benign or small-scale negative consequences" (Manyena, 2006, p 438). Examples of organisations that define resilience in terms of disasters include the United Nations who in 2009 presented the concept as:

"The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (UNISDR, 2009, p 24).

In the literature, examples of authors who define it in this way include de Bruijne, et al., (2010) who highlight the importance of separating this type of resilience from reliability, where the former is the ability to bounce back when the later fails. The focus of this concept is on surviving high-impact, relatively low-frequency events and quickly getting basic urban functions back online, without necessarily addressing the hazard's cause. There are other disaster-centric conceptualisations that include hazard mitigation such as Coaffee and Bosher, (2008). They defined resilience as "the ability of social units (e.g., organisations, communities) to mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimise social disruption and mitigate the effects of future disasters" (Coaffee and Bosher, 2008, p 75). This approach is different to traditional disaster planning and recovery in that: 1) there is a focus on "hazard mitigation and preparedness rather than post-disaster management"; 2) it includes non-natural hazards such as security challenges and accidents; and 3) it includes institutional aspects that focus on protecting infrastructure systems (Bosher, 2014, p 242). Examples include the Council of Australian Government's 2011 National Strategy for Disaster Resilience, which provides guidance "to federal, state, territory and local governments, business and community leaders and the not-for-profit sector" (COAG, 2011, p 3). While focused on an 'integrated' approach, their description of the role of government, as well as that of individuals is clearly based on this conceptualisation. The focus here is on risk awareness and preparedness followed by a "swift, compassionate and pragmatic" recovery intervention (COAG, 2011, p 4).

Davoudi, (2014) suggests that perhaps the reason why this understanding of resilience has gained such support in the past is that the strong emotions it provokes can legitimise action within a political environment. McEvoy et al., (2013, p 285) add that the word resilience has been embraced by the natural hazard community in particular because it allows them to move "beyond an approach dominated by physical sciences for the evaluation of the contribution of social systems to natural hazard risks". When applied to urban policy, this concept tends to bring reactive and short-term approaches that ignore chronic stress and often focus on a single type of hazard (e.g., seismic resilience Sutley et al., (2017) and flood resilience (Goldbloom-Helzner et al., 2015)), potentially missing the opportunity to develop multi-hazard mitigation strategies (Meerow and Newell, 2016). Additionally, if it focuses on "critical infrastructure"[2], this may bring other problems based on what is defined as "critical" and for whom (McIlwain, et al., 2013), as well as whether it considers horizontal, as well as vertical cascading effects across other networks. de Bruijne, et al., (2010, p 28), add to this that the general understanding of disaster resilience is becoming so broad that can describe any attribute that is desirable, thus rendering it "almost meaningless" and leading to little clarity around what should be considered for implementation. This is perhaps a reflexion of the growing body of the literature around this type of resilience. Table 1 provides a summary of core characteristics, policy-implications and criticisms of disaster resilience.

Engineering resilience. This can be defined "as the ability of a system to return to an equilibrium or steady-state after a disturbance" (Davoudi, et al., 2012, p 300) and is often used to describe a type disaster resilience. When applied to urban environments, the control of time becomes essential to this concept. It requires knowing what has, is and will happen to a determined geographic area in order to control the outcomes of a shock event (Hassler and Kohler, 2014a). The central idea is that the system survives as it was; that it "bounces back" to a pre-event "normal" or equilibrium state (Holling, 1973) that is considered "to be more desirable than the present" (Vale, 2014, p 192). It has also been widely used in the literature without the adjective "engineering". Ahern, (2011, p 342) for example defines resilience as "the capacity of system to respond to change or disturbance without changing its basic state". UN-HABITAT's definition of resilience for example falls within this category: "Resilience refers to the ability of human settlements to withstand and to recover quickly from any plausible hazards" (UN-HABITAT, 2012).

Using this concept in urban policy and governance means that the critical success factor is speed of recovery to the system's prior state, and that returning to a state of equilibrium is an indicator of persistence and stability, which are both desirable (Davoudi, 2016). This concept however has been heavily criticised for its use in human settlements. Some critiques have been based on arguments that this approach may "be more acceptable to elastic material than to human systems" and that it "neither captures the changed reality nor encapsulates the new possibilities opened by the changes wrought by a disaster" (Manyena, et al., 2011, p 418).

Table 1 Summary of core characteristics, policy implications and criticisms of disaster resilience

Resilience type	Core characteristics	Policy implications	Criticisms
Disaster	•No single definition •Ensuring benign or small-scale negative outcomes from disaster •Common key words: resisting, absorbing or containing effects of, recovering from and mitigating disaster-related hazards	•Focus on disaster hazard mitigation and preparedness •Hazards include both man-made and natural •Include institutional aspects aiming to protect infrastructure systems	•Focus on short-term damage reduction and recovery (emergencies) •Does not address chronic stress •Often focuses on specific types of disaster, potentially missing opportunities for multi-hazard mitigation strategies (e.g., Tsunami resilience programmes) •Often focused on "critical infrastructure" with potential difficulties in identifying what components are "critical" and for whom •Too broad definition

Table 2 Summary of core characteristics, policy implications and criticisms of engineering resilience

Resilience type	Core characteristics	Policy implications	Criticisms
Engineering	•Aim: return to normal or basic state •Single-state •Pre-event state more desirable than present	•Control of time is an essential part of policy; critical success factor is speed of recovery •Requires knowledge of past, present and predicted future events to control outcomes •Focus on quick recovery from shock events	•Fails to acknowledge opportunities brought by change and integrated approaches •Focus on short-term damage reduction and recovery during emergencies •Does not address chronic stress or hard-to-predict events •Returning to "normal" may not be desirable as previous state was vulnerable

The implication of using this type of concept is that resilience policy tends to be reduced to emergency response with an emphasis on short-term damage reduction and recovery. This tendency may be driven by the perception of the challenges presented to cities and the windows of opportunities they represent (Davoudi, et al., 2012). This poses the question of whether this approach can be suitable to address, in a sustained manner, the diverse range and scales of challenges urban settlements will have to face over the coming decades. Many of these will involve chronic stresses in addition to shock events. Shock events may also become difficult to predict and, when they strike, the question remains of whether the smartest choice is to "return to normal", and what "normal" means. Klein, et al., (2003) for example highlight that if a city experiences disaster, this means that the original state was vulnerable to it and therefore should be an undesirable state to go back to because it would perpetuate this vulnerability. On the other hand, when policies focus only on one type of stress, we could also ask: Are we missing an opportunity to leverage public funds for more integrated resilience policies that address a wider range of stresses? And, should we be addressing the source, as well as the consequences? Table 2 provides a summary of core characteristics, policy implications and criticisms of engineering resilience.

Ecological resilience. Although also an equilibrium-based approach to resilience, this conceptualisation of the term "rejects the existence of a single, stable equilibrium" and is instead based on the idea of multiple equilibria and "alternative stability domains". Here resilience is defined by the speed of recovery to a state of equilibrium (which may or may not be the previous one) and the intensity of the disturbance that it can absorb while remaining within a "critical threshold" (buffer capacity) (Davoudi, et al., 2012, pp 300–301). This perspective focuses on system relationships persisting and remaining functional and controlled while under stress. It "relates to the functioning of the system rather than the stability of its component populations or even the ability to maintain a steady ecological state" (Adger, 2000, p 349).

Anderies, (2014) argues that applying such ecosystem-based understanding of resilience to built environments is challenging due to the emergent nature of characteristics of large-scale ecosystems. Another criticism is that cities are "always in states of uneasy non-equilibrium… and the internal and external pressures for urban change come from multiple directions" (Vale, 2014, p 193). This renders any equilibrium-based understanding of the concept inadequate for coping with the complexity of multi-level, dynamic systems. Another criticism is that stability in any domain may not be a desirable characteristic if long-term survival depends on the evolution of the system (Adger, 2000). Table 3 provides a summary of core characteristics, policy implications and criticisms of ecological resilience.

Socio-ecological resilience. C.S. Hollings, who has been mentioned as the "father" of ecological resilience, "believed that an extended ecological resilience concept could provide a new and useful framework for understanding how the individual, communities, organisations and ecosystems face a number of known and not yet known uncertainties, challenges and opportunities" (Hassler and Kohler, 2014b, p 119). Socio-ecological resilience (SER) then is a transition from the ecological understanding to one that at least includes the human or cultural ecology embedded in a city (Alexander, 2013). It also represents a move from a "descriptive concept to 'a way of thinking'" (Meerow, et al., 2016, p 40).

In short, SER is a systems approach which is based mainly on three aspects: 1) being able to absorb disturbances while remaining within a "normal" or acceptable state; 2) capacity to self-organise; and 3) being able to build capacity for learning and adaptation (Folke, et al., 2002). Therefore, resilience is defined in terms of "the amount of change the system can undergo and still

Table 3 Summary of core characteristics, policy implications and criticisms of ecological resilience

Resilience type	Core characteristics	Policy implications	Criticisms
Ecological	•Equilibrium-based approach	•Focus on urban system relationships remaining functional and controlled while under stress	•Difficult to apply in practice due to emerging characteristics of the system itself
	•Focus on system functionalities being maintained; often defined in terms of buffering capacity	•Success defined by speed of recovery and intensity of disturbance the system can absorb while remaining within a "critical threshold"	•Cities always in uneasy non-equilibrium therefore not applicable to urban governance settings, which are multi-level dynamic systems •Stability may not be desirable if transformation is required

Table 4 Summary of core characteristics, policy implications and criticisms of socio-ecological resilience

Resilience type	Core characteristics	Policy implications	Criticisms
Socio-ecological	•Extends ecological resilience to include human and cultural elements	•Success defined by amount of change the city can undergo while retaining control over functions and structures; degree of capacity to self-organise; and ability to build capacity to learn and adapt	•Challenge in practical application due to difficult to understand cause-and-effect relationships in dynamic complex systems
	•Systems being able to absorb disturbances while remaining within an acceptable state •System components have capacity to self-organise	•Implies cities cannot rely on planned interventions and should focus on developing capacity to adapt and survive	•Difficult to implement in top-down governance system due to requirements of self-organisation of sub-systems •Often fails to consider dynamic technological change and interactions with emerging socio-technical systems
	•Ability to build capacity through learning and adaptation		•Difficulties associated with defining "acceptable state"; acceptable for whom

retain the same controls on function and structure" (same state); "the degree to which the system is capable of self-organisation"; and, "the ability to build and increase the capacity for learning and adaptation" (Berkes, et al., 2003, p 13). This concept acknowledges that cities are complex systems which are constantly changing in an often-unforeseeable way. The challenge of aiming to increase the level of this type of resilience within a "desired system state" is the need to understand how actions to address one threat influence the whole socio-ecological system (Adger, et al., 2011, p 758). This concept also implies that cities cannot be governed through planned interventions but instead should rely on their capacity to adapt and survive (Davoudi, 2016). Examples of organisations using this concept include the Resilience Alliance (Resilience Alliance, 2017), which is an international research organisation that often produces industry-oriented publications such as "Assessing Resilience in Social-Ecological Systems: Workbook for Practitioner's" (Goldbloom-Helzner, et al., 2015).

Because this conceptualisation is based on systems theories, it requires self-organisation of sub-systems that are formed by "independent agents interacting at local scales". This is also a challenge for its application to urban environments with a top-down governance system (Anderies, 2014, p 132). Additionally, most literature in this area often fails to consider dynamic technological changes and interactions with emerging socio-technical systems (Smith and Stirling, 2010). While this might not have been a significant limitation in the 1970s when this theory was first developed, it certainly is nowadays when technology and socio-technical systems are becoming central to the way cities are managed. It also raises the same question as previous concepts of what "normal" or "acceptable" means (Davoudi, et al., 2012). Table 4 provides a summary of core characteristics, policy implications and criticisms of socio-ecological resilience.

Evolutionary resilience. This concept is derived from SER with an adapted panarchy model of adaptive cycle that has four phases of change: Growth, conservation, creative destruction and reorganisation.[3] It has the same elements as SER but advocates that "the very nature of systems may change over time with or without an external disturbance"; this has been also included within SER by some commentators but its proponents reject this perspective (Davoudi, et al., 2012). This concept also challenges the idea of the existence of an equilibrium and advocates for understanding cities not only as complex but also as dynamic and constantly changing systems. In terms of policy it implies seeing recovery as an opportunity to re-build the city into an optimised or improved system. This is often referred to as the ability to "bounce forward" (Manyena, et al., 2011) to which we come back in what follows. It presents resilience as a continually changing process rather than an end-objective. As with SER, this concept focuses on disturbances which can be chronic slow stresses or acute rapid shocks, but emphasises the fact that the past is not a "reliable predictor of future behaviour" of the system (Davoudi, et al., 2012). This concept was used for example to develop the City Resilience Index currently used by the 100 Resilient Cities (Arup, 2014) which is not only being used by 100 of some of the world's most economically influential cities but also arguably started to permeate to other levels of government. This approach also characterises the Christchurch Central Recovery Plan (Canterbury Earthquake Recovery Authority, 2012). This plan arguably has used the devastating 2010–2011 earthquakes as an opportunity to "rebuild better". It also describes the reorganisation (referred to as transition) phase as providing "opportunities to test new ideas, explore new concepts and look at new ways to bring people, business and investment back to the central city".

Within a disaster scenario, this concept presents challenges for policy-making in that focusing on renewal after an extreme event

may require significant political will (Davoudi, et al., 2013) to be maintained over a long rebuilding processes. This concept also falls short by not accounting for the dynamic role of technology within cities and only highlights disturbances as opportunities but does not provide practical insight into how to deal with complex governance systems during the "reorganisation" phase. Table 5 provides a summary of core characteristics, policy implications and criticisms of evolutionary resilience.

Built-in resilience. Bosher's, (2008) book is perhaps one of the first publications found where a resilient built environment is explored in detail. This publication was used in 2014 to develop the built-in resilience concept, which is defined as "a quality of a built environment's capability (in physical, institutional, economic and social terms) to keep adapting to existing and emergent threats" (Bosher, 2014, p 241). While previously reviewed concepts can theoretically be applied to community resilience, which perhaps has a more social emphasis, built-in resilience emphasises the role of the built environment industry. This concept focuses on the idea of intuitively and proactively coping with dynamic changes. Examples include some of Resilient Rotterdam's approach to water-related threats (100 Resilient Cities, 2015b) where water plazas double as social and storm water infrastructure.

Bosher explores practical implications of resilience thinking for built environment practitioners. Supporters of this term suggest a mix of structural and non-structural/cultural change solutions to operationalise the concept while acknowledging the difficulties of doing so due to the complexity of the task. Another implication of built-in resilience is the interpretation that discussing disasters as "natural" can be counterproductive in policy development because it "absolves many stakeholders from blame" (Bosher and Dainty, 2011, p 3). This opens the door for mitigation to be considered as part of resilience more broadly and has led others to advocate for more integrated and proactive resilience planning. However, when studying Bosher's original concept, this focuses on withstanding, recovering and mitigating extreme hazards, which limits the scope by not including chronic stress.

Although Bosher, (2008) briefly explores social long-term stress such as economic downturn, this is only framed within the context of how it impacts the outcomes of extreme events. The literature about built-in resilience then also tends to focus only on disasters. See for example Bosher, (2014), Bosher and Dainty, (2011) and Bosher, et al., (2007). Table 6 provides a summary of core characteristics, policy implications and criticisms of built-in resilience.

Climate change resilience. This term is used more generally to apply resilience principles to climate-change-related risks mitigation. Australia for example has recently released its National Climate Resilience and Adaptation Strategy which deals with climate change adaptation and mitigation (Australian Government, 2015). This concept is used to "emphasise the idea that cities, urban systems, and urban constituencies need to be able to quickly bounce back from climate-related shocks and stresses" (Leichenko, 2011, p 164). The Asian Development Bank published a report on this topic in 2014, stating that it describes cities that can survive shocks and stresses; include people and organisations that can deal with these stresses in their every-day decision-making; and have institutional structures that support them in fulfilling their aims (Asian Development Bank, 2014). They defined urban climate change resilience as embracing "climate change adaptation, mitigation actions, and disaster risk reduction while recognising the complexity of rapidly growing urban areas and the uncertainty associated with climate change" (Asian Development Bank, 2014, p 4). Examples include Australia's National Climate Resilience and Adaptation Strategy which provides general principles and vision for climate resilience practice across the different levels of government in Australia, therefore influencing a large number of regional and local strategies and action plans (Australian Government, 2015).

This approach of dealing with climate change separately has however also faced many criticisms. Researchers such as Adger, et al., (2011) focus on how climate change policies and system resilience interact by exploring the sustainability, or lack thereof, of adaptive responses in relation to their long-term effects. They advocate for this type of initiative to be integrated more holistically with system thinking. Leichenko, (2011, p 165) additionally highlights that climate change is just one source of shocks and stresses, and that "promotion of urban resilience to climate change will thus require that cities become resilient to a wider range of overlapping and interacting shocks and stresses".

Table 5 Summary of core characteristics, policy implications and criticisms of evolutionary resilience

Resilience type	Core characteristics	Policy implications	Criticisms
Evolutionary	•Adapted panarchy model from socio-ecological resilience •Four faces of change: Growth, conservation, creative destruction and reorganisation •Cities seen as dynamically changing systems	•Recovery is seen as an opportunity for improvement ("bouncing forward") •Resilience is a process that aims to address chronic stress and acute shock •Past not a reliable predictor of future behaviour to base policy on	•Renewal after a disaster may require political will for longer rebuilding efforts •Does not account for the dynamic role of technology within cities •Does not provide practical insight for complex governance networks during reorganisation phase

Table 6 Summary of core characteristics, policy implications and criticisms of built-in resilience

Resilience type	Core characteristics	Policy implications	Criticisms
Built-in	•Focuses on built environments •Capability to keep adapting to existing and emergent threats •Includes physical, institutional, economic and social elements	•Focus on proactive strategies to cope with dynamic change •Operationalisation most likely requires structural and non-structural solutions	•Original concept focused on extreme hazards only, failing to consider chronic stress •Social long-term stress only addressed as influencing factor for magnitude of consequences of extreme events •Literature mostly focused on disasters

Table 7 Summary of core characteristics, policy implications and criticisms of climate change resilience

Resilience type	Core characteristics	Policy implications	Criticisms
Climate change	•Apply "resilience principles" to climate change action •Focus on bouncing back from climate-related shocks and stresses •Includes disaster risk reduction •Recognises uncertainty and complexity of rapidly growing urban areas	•Focus on climate change mitigation and adaptation •Institutions and people developing capacity to deal with stresses in every-day decision making •Aims to have institutional structures that support others in fulfilling their aims	•Policies often include unsustainable adaptive response •Requires better integration with systems thinking •Misses the opportunity of becoming more resilient to a wider range of interacting disturbances •Needs to be developed in conjunction with sustainability and urban development efforts •May lead to lack of deliberation around extreme measures

Therefore, efforts to increase climate change resilience need to be handled in conjunction with urban development and sustainability. Davoudi, (2014, p 372) also suggest that "the perception of climate change as a 'threat multiplier' may lead to the justification of exceptional measures as the undisputed and necessary action". Table 7 provides a summary of core characteristics, policy implications and criticisms of climate change resilience.

Other conceptualisations of urban resilience. There are other emerging conceptualisations referenced in the literature on urban resilience but most have not (yet) been defined in detail. Angeon and Bates, (2015) for example differentiate between "stable" and "unstable" resilience. In this sense, unstable resilience can lead to worsening situations in the face of severe shocks. They relate the term to contained or uncontrolled vulnerabilities. Here, unstable resilience and contained vulnerability are temporary states, while stable resilience reduces the possibilities of quickly falling into uncontrolled vulnerability, which in turn can persist without drastic action.

Vale, (2014) discusses "anticipatory" and "reactive" resilience while arguing for the implementation of more holistic and progressive forms of anticipatory resilience in politics and policies. The main difference between the two approaches seems to be the time scale of action, with reactive forms of resilience leading to more urgent action and anticipatory forms leading to actions that aim to limit future problems. Anderies, et al., (2013, p 4) further suggest the term "general resilience", which "refers to broader system-level attributes such the ability to build and increase the capacity for learning and adaptation". All these terms, and many more available in the literature, however have not been greatly explored in terms of how they can be operationalised into comprehensive urban policies and governance interventions.

The 'why' of urban resilience: critiques to conceptualisations and counter-critiques

As we already stressed in the introduction to this article, considering the complexity of urban policy and governance, the plurality of understandings of urban resilience comes with opportunities and challenges alike. The plurality of understandings has also resulted in ongoing critique to specific conceptualisations, which themselves have resulted in counter-critiques. In what follows we discuss these.

Different points of departure: bouncing back, falling forward and persistence. It has been argued that the inherent notion of 'bouncing back' to a pre-disaster state or a desire to maintain a known way of living underlying many of the resilience understandings discussed before often does not challenge policy-makers to consider a disaster as an opportunity for learning, as well as an opportunity to build back stronger or better (Davoudi, 2014). With a desire to quickly respond to a disaster and facing limited funds, known and inexpensive solutions are sought before more complex and expensive ones are trialled (Tainter and Taylor, 2014). On many occasions, the building or rebuilding with uniform, generalised technical solutions may not solve the inherent problems underlying disasters, or create new and more difficult ones (Hassler and Kohler, 2014a; Register, 2014). Patchwork repairs of infrastructure in cities post-disaster does not, for example, solve the inherent legacy problems of 19th and 20th century urban planning—technology lock-ins, poor quality urban critical infrastructure and unnecessary redundancies (Hassler and Kohler, 2014a). This is reflected in the US infrastructure scorecard produced by the American Society of Civil Engineers (ASCE). The estimated required investment needed to repair, maintain and, when irreparable, substitute existing infrastructure was USD3.6 trillion in 2013, with all but solid waste infrastructure being awarded a mediocre or poor rating. This led ASCE to propose the promotion of sustainability, resilience and maintenance as a key part of infrastructure management strategies (Victor, et al., 2013).

Moffat, (2014) refers to this phenomenon as the result of having "high time preferences", which means valuing the present above the future. This trend, he argues, generates a perception of time which is incompatible with cycles that shape civilisation and devalues the key idea of resilience. Cities are formed over long periods of time and by merely focusing on short-term "wins" their long-term survival may be threatened (Moffatt, 2014). Also, with disturbances occurring with higher frequency, it will become too costly to bounce back to pre-emergency states of affairs, or such bouncing back may be possible for some but not others and increase inequalities between city dwellers.

Rather than seeking to 'bounce back', failures, crises and disasters may be an opportunity, so argue others, to 'fall' (Gunter McGrath, 1999) or 'bounce' forward (Manyena et al., 2011). This is an established notion in the management literature but has only recently entered urban resilience scholarship and policy. However, what this opportunity means may have different interpretations. Hurricane Katrina in 2005 is perhaps one of the better-known examples of socio-economic characteristics of a city amplifying disaster and complicating recovery (Vale, 2014). It flooded 80% of New Orleans, caused damages equivalent to 1.2% of the US GDP and displaced over 380,000 residents. Its effects were worsened by uncertainty about repairing levees, the complexity of the US governance system and an inadequate understanding of negative feedbacks between critical infrastructure networks, but also by factors such as the geography of poverty and the complexity of the American way of life (Tainter and Taylor, 2014; Townsend et al., 2006). At the time, many

(including politicians and local high-ranking civil servants) went as far as saying that because of the pre-disaster socio-economic characteristics of New Orleans and the post-disaster scale of damage, the city should not even be rebuilt (Campanella, 2006), or at least not in its original form. It may therefore be a thin line for some between considering a disaster an opportunity to fall forward and rebuild stronger and better, and considering it a unique moment to push out unwanted minorities and jump on the bandwagon of neo-liberal urban planning seeking economic gain over social equality (Davidson and Martin, 2014).

It has been argued before that what is resilient is not always sustainable in an urban setting; and what is sustainable is not always resilient (van der Heijden, 2014), but more is at stake. Another notion driving resilience action and literature is that of persistence. The idea of persistence relates in part to resisting disturbances and to a degree maintaining status quo or at least retaining certain functions (Meerow, et al., 2016). Yet, more than the ideal of bouncing back or maintaining a desirable way of life and level of economic activity (Tainter and Taylor, 2014) it requires making "difficult choices about which parts of the built environment should receive investment and, therefore, which people should benefit" (Vale, 2014). "Addressing the question of what kind of resilience and for whom foregrounds the qualitative nature of adaptation and adaptability not just their quantitative extent", conclude Pike et al., (2010, p 60). They base this conclusion on a study of resilience policies in old industrial regions in the United Kingdom, the United States and Germany. Here they found that those which focus on the short-term, going back to "previously successful development paths" versus those that aim to build a capacity to adapt to unforeseen futures result in considerably different outcomes in social, economic and environmental terms. The first approach tends not to be very successful as is highlighted by the United States' rust belt with its current high levels of unemployment and low economic prosperity—which has been argued by political commentators to have decided the election of President Trump (Bloomberg, 2016; Longworth, 2016; McQuarrie, 2016). The latter approach on the other hand has resulted in Germany's rebirth into a renewable energy beacon.

While most of the literature involved in this debate focuses on physical infrastructure, Hassler and Kohler, (2014a) argue that both material and cultural components of cities have to be considered when long-term resilience and persistence are the objective. Such notions are expanded by those of, for instance, the 100 RC programme that argues that the capacity to continue to grow should also be maintained, presumably indefinitely (100 Resilient Cities, 2015a). Within this context, developing the capacity to persist challenges policy-makers to take proactive approaches to risk mitigation and abatement at different time-scales. It is about reducing the likelihood of stress events occurring and affecting the system in the short, medium and long-term across a wide range of aspects. If persistence is the goal then, Register, (2014) argues: "if we start thinking in really basic terms, we may realise that the city that is best for adaptation adapts least – because… it doesn't have to". In this sense, urban resilience policy should not seek to adapt to changes while ignoring the root cause, principles and likely futures. This however may be significantly difficult given the wide range of variation across scopes and potential futures discussed in the literature.

Other urban goals: conflicts, synergies and redundancies. A second and related key critique considers the mismatch between urban resilience conceptualisation and operationalisation and other aspects of urban policy and governance. Ideally, the whole of resilience policies and measures is larger than the sum of its parts (van der Heijden, 2017). Typically, the fragmented nature of governance systems translates into the incompatibility of policies by different actors, resulting in local policies being undermined or contradicted by those at other governance levels or even within different functional areas of the same level (Anguelovski and Carmin, 2011; Birkmann, et al., 2010; Potsiou, 2010). A lack of local expertise or a clear role for local and other authorities when working with these kinds of policies and measures will likely strengthen such conflicts (Amundsen, et al., 2010). The impact of these factors is higher at metropolitan level strategies given the wide variety of actors involved in urban resilience policy and action—government, business, civil society—as well as the various levels of policy and action—local, regional, national and international (Reisinger, et al., 2014).

High hopes are expressed about building in redundancies to prevent such conflicts and achieving synergies between urban resilience and other urban policy goals and measures (McIlwain, et al., 2013; Anderies, 2014). Yet, redundancies come with their own complications, particularly in terms of achieving efficiency under a constrained budget (Anderies, 2014; Fiksel, 2003). The different points of departure for urban resilience policy—bouncing back, falling forward, persistence—may be expected to result in specific conflicts with other urban policy goals and opportunities for achieving synergies.

For the notion of bouncing back, conflicts may be expected when assigning time scales of action (Ahern, 2011; Berkes, et al., 2003). The strong desire to act quickly in the here and now in response to or to prevent disaster, and to maintain our way of living may have ripple effects that only become apparent long after a policy or measure has been implemented. The urban system's adaptive capacity may be considerably compromised when a single component, community, or even an individual (with enough power) does not align with the larger system (McIlwain, et al., 2013). An intervention may then act as a patch in the short run (Howlett and Rayner, 2013) but may have disruptive effects in the long run, or may simply further strengthen existing lock-ins (Ahern, 2011).

Here redundancies may be particularly helpful when sought in planning and decision-making processes (Chelleri, et al., 2015; Schlüter and Pahl-Wostl, 2007). Moving from centralised decision-making approaches to decentralised, multi-level or even polycentric approaches allows to make use of the tacit knowledge of actors and organisations closest to the problem that may result in or has resulted in a disaster (Collier, et al., 2013; Homsey and Warner, 2015). These approaches can allow local agents to act swiftly based on their in-depth understanding of the issues at smaller scales in coordination with other agents to simultaneously work towards resolving issues at larger scales. In similar vein, moving from government-led processes to more inclusive and collaborative ones that allow for citizen, civil society and private sector participation will provide another opportunity to make optimal use of tacit knowledge and challenge solutions that may otherwise seem adequate to policy-makers (Van der Heijden, 2015).

For the notion of falling forward, conflicts may be expected, particularly across actors and organisations. The strong desire to consider a trigger event such as a disaster an opportunity to move forward may not resonate well with, particularly, the victims of that disaster. For them, rebuilding to a pre-disaster state may be important not only for economic and technical reasons, but also for emotional and social ones (Ahern, 2011). Besides, lengthy debates about what it implies to build back better and stronger might not always be desirable when the continuation of critical urban infrastructures and the services they provide is at risk (Register, 2014).

On the other hand, connectivity across network scales has been raised as a central characteristic of resilient urban systems (Ahern, 2011). Further than simply highlighting the existence of obvious connections between networks this line of thought points towards vertical and horizontal cohesion across and within networks; unifying forces and linkages to move the system away from fragmentation (Fiksel, 2003; Fiksel, 2006; McIlwain, et al., 2013). This cohesion increases the adaptability of the system by maintaining the linkages that enhance its ability to act and change in a timely manner (Davoudi, et al., 2013). Linking actors and organisations across networks aids learning across urban systems (Anderies, 2014). Such linkages are, however, unlikely to materialise without some sort of horizontal and vertical coordination (McIlwain, et al., 2013).

Finally, for the notion of persistence, conflicts may be expected across society because its meaning will vary across and within countries, cities and communities (Adger, et al., 2005). This notion is the most challenging of the three, and asks policy-makers, citizens and others to move out of their comfort zone to make difficult choices about and act to achieve a desired future (Vale, 2014). Again, redundancies may be sought in decentralised, multi-level, or polycentric governance and more inclusive and collaborative governance approaches. But also, accepting diversity in and of urban systems is relevant here. Redundancy and diversity allow the system to continue to function even when certain subsystems or components fail (Anderies, 2014). Ahern, (2011) further adds that this diversity should refer to ecological and social components of the system in addition to technical components, and that redundancy should be accompanied with modularisation. Modular networks require the system to be composed of multiple smaller systems "that are relatively independent of each other, complement each other, to a certain degree replicate each other, and are buffered from each other to minimise the transmission of shocks" (McIlwain, et al., 2013). Modularity allows subsystems to evolve with a certain level of independence from the whole (Anderies, 2014).

It supports response diversity within single functions while being able to perform more than one function either simultaneously or consecutively (Ahern, 2011). This characteristic can be complementary to diversity where one component can create redundancies by performing multiple functions to maximise the efficiency of the resource investment (Ahern, 2011). It is also closely related to the capacity to persist in that by using resources more efficiently fewer resources are needed, which itself helps linking urban resilience goals with urban sustainability goals (Fiksel, 2003; Register, 2014).

Reach: bridging long and short term, bridging small and large scale. A third and again related critique revolves around the time and geographical scale of resilience conceptualisations. Different understandings of resilience (Table 1) and different points of departure of resilience policy (bouncing back, falling forward, persistence) will have varying impacts on the timespan and scale of urban resilience policy and governance. The temporal scale, type, intensity and variety of disturbances the urban system is to withstand, the type of actions to be taken (preventive or reactive) and the parts of the systems that are desired to persist vary across resilience concepts and policies. SER for instance requires designing the system so it can absorb disturbances that range from shocks to emerging, chronic pressures (Trigg, et al., 2010). However, it also allows for transformation to occur, especially if using an evolutionary resilience view (Davoudi et al., 2013). Planners can then implement uncertainty or adaptation management which promotes taking actions either to prevent and reduce future risks or "to recover losses after a risky event" (Jabareen, 2013, p 225). The disturbances being addressed and the temporal scale considered therefore may bring a focus on short-term disaster management or long-term prevention of disruptions to urban activities through, for example, climate change mitigation. Vale, (2014), for example, is particularly critical about the asymmetry of priorities brought by government officials' electoral cycles versus long-term resilience needs. Public officials are pushed to focus on short and medium-term goals linked to their election cycles. This limits the incentive to establish long-term horizons and invest in resilience initiatives that proactively target the root causes of future problems and increase the capacity to respond in real time to challenges as they arise. Critique of this 'short-termism' echoes that of the dominant notion of 'bouncing back' (Davoudi, 2014).

This is not to say that the temporal focus of urban resilience policy is an 'either or' choice—that is, either short-term or long-term. Seeking to bounce back after a disaster, policies may focus on the speed of action and recovery within a short-time scale. For example, policies may deal with recovering telecommunications, water and electricity infrastructure as fast as possible after a disaster occurs because these directly affect the duration and intensity of the urban recovery effort. At the same time, a medium to long-term falling forward strategy may be in place. In such cases, the recovery effort may also include renewal so the new state of the city after disaster is more resilient to future disturbances than the previous state (Meerow, et al., 2016; Davoudi, et al., 2013). Policies that focus on long-term resilience must also consider the desired future characteristics of the city and continually act towards those goals, without the need for a disaster to happen. This would require policy-makers to envisage future land-uses and technologies, as well as define a course of action that will promote change across specific networks without a trigger (i.e., a disaster) which may be challenging (Bettencourt, 2015). However, it would also allow them to do these changes in a well-planned and sourced manner, significantly more efficiently than in a post-disaster setting. It is here where the notion of persistence may be a guiding principle to bind together short, medium and long-term resilience policies and interventions.

Likewise, the temporal scale of urban resilience interventions varies across resilience concepts and policies. Engineering resilience and built-in resilience for instance can have a very small-scale focus. The persistence of a power-grid may depend on a small but critical technological artefact—a powerline, a fuse in a powerline, or even a bolt holding that fuse—and engineering and built-in resilience hold that these artefacts should be able to absorb disturbances, or that sufficient redundancies are in place would the artefact fail (Labaka, et al., 2015). In contrast, ecological resilience can have a very large-scale focus. Facing climate change, the whole planetary system is at risk and urban environments are core sources of carbon emissions and other wastes that contribute to climate change. At the same time, urban environments are particularly subject to climate change risks such as extreme weather events and sea level rise (Birkmann, et al., 2010; Adger, et al., 2011). SER brings awareness of, on the one hand, the need to have a proactive approach based on long-term planning that addresses the potential for future damage rather than the degree of damage caused by past events (McIlwain, et al., 2013). On the other hand, policy-makers may struggle with the number and diversity of potential future risks, as well as the lack of understanding of long-term effects because they would need to answer the question of adapting to what, how and within which spatial scale (Urwin and Jordan, 2008).

Besides the timescale of urban resilience thinking, scholars also critique the dominant 'within city' scale of such thinking; cities are connected systems of people, resources and information that have a global impact both as individual cities, as well as the

systems they make up as larger collectives. Ernstson et al., (2010) are most vocal about this issue and suggest distinguishing between 'resilience in cities' and 'resilience of cities'; perhaps similar to the more recent "ecology in cities" versus "ecology of cities" in ecosystem sciences (Pickett, et al., 2016). Resilience in cities reflects dominant resilience thinking in terms of urban form, land use patterns, and local and spatial ecological processes. Resilience of cities on the other hand would ask for novel theories to better understand "the dynamic interlinkages between social and technical networks that sustain energy, matter, and information, and how these dynamic networks influence ecological networks and the capacity to generate local-to-regional ecosystem services" (Ernstson, et al., 2010, p 545). Another issue related to smaller spatial scales may be that resilience is often only addressed through infrastructure changes. As highlighted by Poole, et al., (2014), this brings additional challenges due to the need for large capital investments, cost and revenue being uncertain over the long term, the lack of market mechanisms in public infrastructure, and path-dependency and irreversibility of investment.

Again, the scalar focus of urban resilience policy is not an 'either or' choice—that is, either small-scale or large-scale. As with the temporal focus, the notion of persistence as a point of departure for urban resilience policies may bind together a desire to bounce back and a desire to fall forward. Local bouncing back-type recovery efforts for New Orleans, for example, have resulted in important lessons and best practices that are now transferable to other locales (Fussell, 2015; Kato, et al., 2013). From a persistence point of view, in acknowledging that such disasters will recur, policy-makers and organisations such as city-to-city networks may put forward experimental governance regimes to trial fall forward recovery measures not only to increase urban resilience at the local scale, but predominantly to draw lessons on how urban resilience could be strengthened across the globe (Bulkeley, et al., 2015; Evans, et al., 2016).

Conclusion

Urban resilience policy is a complex and evolving field characterised by significant challenges associated with urban governance systems, political pressures, uncertain and emergent nature of threats, speed of change and the level of complexity of long-lived networks that form cities. Added to these issues, there are a number of resilience concepts that can potentially be used to develop such policies. These various conceptualisations come with a range of critiques, the most dominant being that they have a too strong focus on, for lack of a better term, bouncing back and seeking to maintain a known way of living; that they do not align well with other urban policy goals; and that their focus is too short-term and too small-scale.

Having reviewed the peer-reviewed literature since the 1970s, we argue that considering the 'what' of urban resilience (the conceptualisations) is equally important as considering the 'why'. Although this analytical distinction in 'what' and 'why' has intuitive appeal, we have not seen it made as such in the literature. Regarding the 'why', while we have referenced a few organisations as examples, this has been done for illustrative purposes rather than as comment on what these organisations do in reality, and have not at this point done a thorough assessment of whether their concept is in line with their actions. This is therefore a potential area for future research. We have, however, distinguished between the traditional notion of bouncing back in urban resilience conceptualisations, the notion of falling/bouncing forward (in which disasters are considered an opportunity to improve the urban system), and the notion of persistence (in which difficult choices have to be made about what kind of future urban systems we want to live in). It is noteworthy to highlight that while these terms are commonly used in the literature, they do not always result to be helpful for "real-world" policy-making and city planning.

Particularly for policy-makers it appears relevant to distinguish between these two aspects when developing and implementing urban resilience policies. Addressing the 'why' helps them legitimise choices made and issues included in urban resilience policies, as well as legitimising issues not included. Equally important, because the notions of bouncing back, falling forward and persistence are not mutually exclusive, policy-makers may wish to combine them to achieve more holistic urban resilience policies and governance interventions. Some issues may best be addressed in a bouncing back manner (say, immediate water supply) whilst other issues may best be addressed in a falling forward manner (say, building back a decentralised, non-fossil fuel dependent power grid), and so on. Likewise, addressing the 'why' helps legitimise choices, but also challenges policy-makers to think of different solutions in addressing specific urban resilience issues and risks. The different conceptualisations provide different solutions that all come with their own financial, practical, political, reputational, and so on, opportunities and constraints. Having insight in these will help to make informed decisions about what solution works best in a specific situation. Addressing the 'what' and 'why' will help them to develop tailormade policies, including redundancies to achieve synergies between different policy goals, and linkages between short and long-term, as well as small and large-scale foci of urban resilience policies.

Distinguishing between the 'why' and 'what' of urban resilience is of relevance for academics also. Particularly when considering the fate of the notion of 'urban sustainability' and the notion of 'sustainability' more generally (Washington, 2015; Knieling, 2016), most will agree that we are not served much by turf wars between one conceptualisation of urban sustainability versus another. The various conceptualisations (and their followers) all appear to have a mutual goal: to work towards cities that can withstand, adapt to or otherwise respond to sources of stress and be able to continue operating. The various conceptualisations mostly address the 'what' of urban resilience, as we have highlighted in our meta-analysis. The 'what' of urban resilience appears, however, to provide cross-cutting themes that bind the various conceptualisations together. Thus, rather than becoming too narrowly focussed on the 'what' of urban resilience, we challenge those scholars who feel more at ease with one conceptualisation than another to focus on the 'why' of urban resilience also. It is here where we see opportunities to study how the limits of one conceptualisation (and its solutions) can be overcome by the strengths of another, and vice versa. By bringing attention to the analytical distinction between the 'what' and the 'why' of urban resilience, this article has opened a series of research questions for future scholarship to address. These include, but are not limited to, how can dominant critiques be resolved in practice to achieve urban resilience policies with long-term objectives across scales; and how can financial, political and operational pressures be overcome to deliver sustained coordinated action towards a cohesive vision of resilience?

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Notes

1 A full overview of titles is available from the authors on request.

2 Critical Infrastructures can be defined as systems, services and assets that are vital for the welfare of society, and whose disruption or destruction has severe impact on the health, security, safety or economic wellbeing of citizens and on the effective functioning of government (Labaka, et al., 2015).

3 The original panarchy model phases were: Exploitation, conservation, release and reorganisation (Gunderson and Holling, 2002).

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Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Additional information

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